Face Recognition and RFID Verified Attendance System

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Face Recognition and RFID Verified Attendance System

Md. Sajid Akbar
Department of Electronics and Communication Engineering
BRAC University
Dhaka, Bangladesh
sajid_sium@ieee.org

Pronob Sarker
Department of Electronics and Electrical Engineering
BRAC University
Dhaka, Bangladesh
k9slash@gmail.com

Ahmad Tamim Mansoor
Department of Electronics and Electrical Engineering
BRAC University
Dhaka, Bangladesh
mansoortamim407@gmail.com

Abu Musa Al Ashray
Department of Electronics and Electrical Engineering
BRAC University
Dhaka, Bangladesh
musaashary0@gmail.com

Jia Uddin
Department of Computer Science and Engineering
BRAC University
Dhaka, Bangladesh
jia.uddin@bracu.ac.bd

***Abstract*— Proper attendance management is crucial for the academic institutions to disseminate and ensure quality education to every student. This paper presents a model of an automated attendance system to alleviate the manual effort of recording data eliminating the chances of fraudulency. The model focuses on how face recognition incorporated with Radio Frequency Identification (RFID) detect the authorized students and counts as they get in and get out form the class room. Smart Attendance System keeps the authentic record of every registered student and eradicates greatly the traditional tedious task. Moreover, this smart system keeps the data of every student registered for a particular course in the attendance log and provides necessary information according to the need. By recognizing the face of the individual and verified by RFID simultaneously in our project, the limitations in the existing manual attendance system are mostly eliminated. Another added feature to the project is that we are saving energy by implementing a system using IR modules where the room's electronics only turn on when there are people inside.**

Keywords*— *Image Processing, OpenCV, Facial Recognition, RFID Tags, RFID Readers, Arduino Project, IR Module, Class Attendance, Smart Classroom

I. INTRODUCTION

Regular attendance in class is, undoubtedly, the most prior condition for the students to ensure a good academic result. Lack of proper and efficient monitoring system cause the students to refrain from attending the class regularly which in turn brings a very sad performance in the exam. Consequently, valuable time and energy of the students are wasted, sometimes they are dropped out and the reputation of the academic institute sharply declines [1]. Apart from this, engaging of the teacher to take attendance halts the continuity of the class and that hampers the quality of the class as well. On the other hand, a minimum of 70 percent attendance for each course is mandatory to avoid being barred from the exam. In [3], a system was proposed, where a student can also know the information regarding his attendance beforehand so that he can be cautious of it. The traditional attendance system drastically fails to solve these problems effectively that has eventually become a great concern nowadays.

Our improved system working on recognizing face with identification number leaves no loophole of fraudulence and it can initiate a smarter system that addresses each issue mentioned above more accurately without any sort of manual mistakable effort. Images of the face of every student with their name and identification number once recorded, our present system can recognize each student and count while he enters the class by verifying his face and RFID based identity card [4,9,13]. All sorts of mismanagements, fraudulence, and carelessness will disappear and no more hindrance for the teacher to continue class smoothly. Students will not deprive from a quality class.

Several projects have been done by using Arduino for developing smart attendance system. Since students from different countries, specially, from developing and underdeveloped are rapidly growing [3-5], the necessity and popularity of automated system based smart classroom projects are increasing. For example, IR module-based project for smart classroom has been implemented in different places [7]. Besides, Bluetooth module attendance system by pairing the mobile phone devices has been used by different universities [4]. Another project that we got to know during our research is GSM based automated classroom system [4].

Previously, RFID based classroom system has been proposed using raspberry pi and ATmega32 development kit [6]. However, raspberry pi or ATmega32 development kit does not make our project cost efficient [5]. We are going to make this project for the educational institutes; hence besides the insurance of accuracy and authenticity, cost effectiveness is also a big concern to us.

In this paper, we proposed an attendance system based on Face Recognition and Verified the information by RFID and thus keep records by recognizing face, identifying identification number, entry and exit time by Real Time Clock (RTC) module [9-11]. This information can be logged by using SD card or by uploading it to the internet by using an Ethernet shield, as per clients' need [14].

The following parts of the paper are put in an order as such. Section 2 focuses on the model of our project that we have already proposed. Section 3 represents the circuit diagram with proper illustration and also how we had implemented our hardware of this project. Finally, Section 4 is the conclusion where we also discussed about the future scope.

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II. PROPOSED MODEL

Here a detailed block diagram of Attendance System based on Face Recognition and Verification with RFID is depicted in Figure 1. Face recognition part is done through several steps [12-15]. As our code prepared with Python in Open CV generates 2D grayscale images of the students that work as the input and after being trained on those images, the system finally detects faces on live camera feed [10,11].

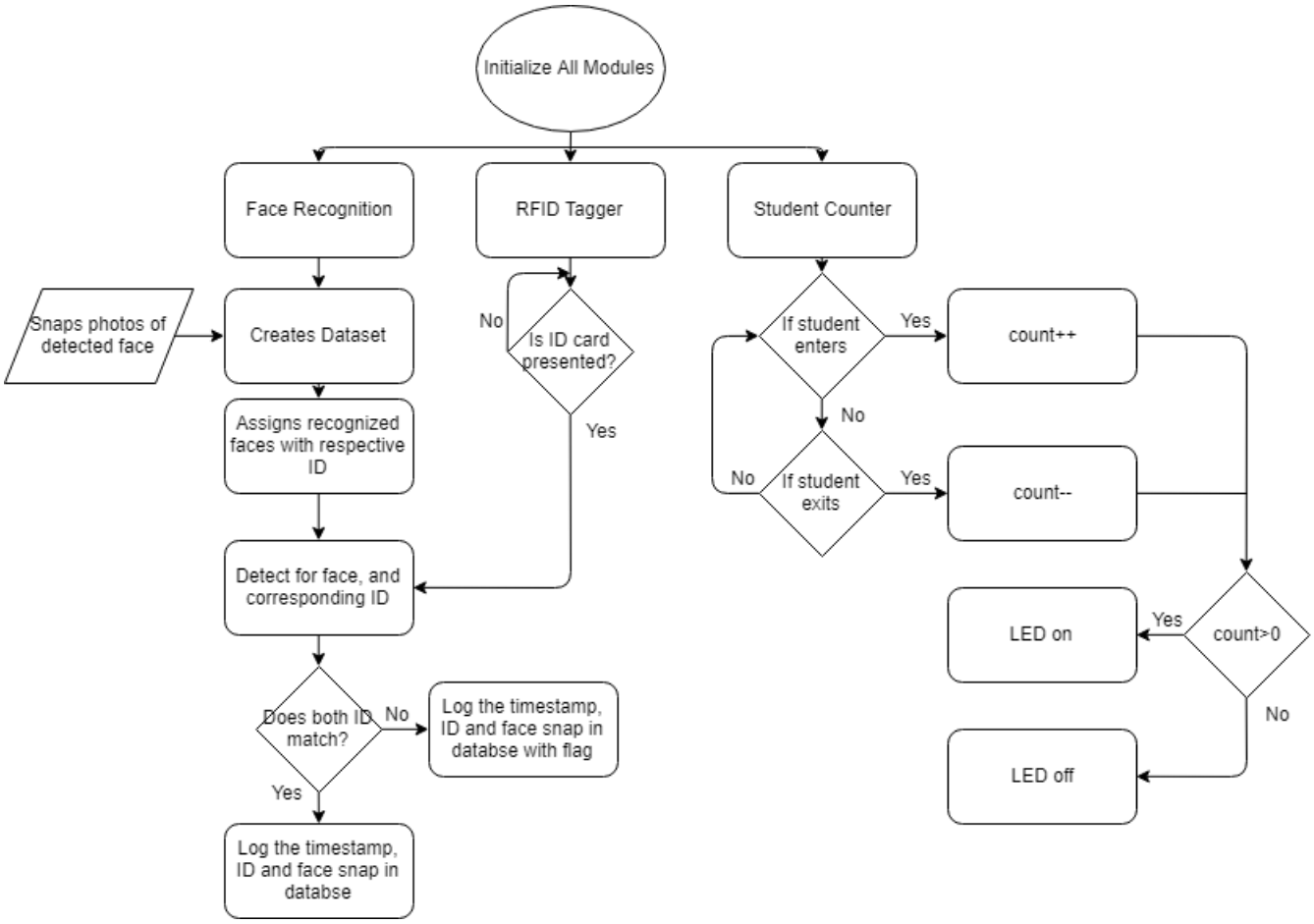

Figure 1. Flowchart of the proposed circuit model

Radio frequency identification (RFID) system is based on two components which area reader and a tag. Here the tag is attached to an object and the reader identifies the proper object. The data here is transmitted by using radio wave [2].

The RFID tag has an embedded transmitter and receiver. Atypical RFID tag consists of two parts, an integrated circuit and an antenna. The integrate circuit is used for collecting and running information. And the function of the antenna is to receive and transmit a signal [4]. RFID tags can be of three types and they are active, passive, battery assistive passive [3]. RFID tags are equipped with non-volatile memory storage [5].

The RFID reader transmits an encoded radio signal to the RFID tag by using a two way transmitted receiver which is also known as transceiver and interrogate [1]. All the RFID tags that are available fall in three categories. They are classified according to the type of tag and reader. Those are, Passive Reader Active Tag (PRAT), Active Reader Passive Tag (ARPT) and Active Reader Active Tag (ARAT) [2]. We have used the second one for our proposed model.

The Facial Recognition is done using OpenCV library and running the respective codes on Python [14]. We have used OpenCV 2.4.0 and Python 2.7.13 specifically for this particular project, and the latter versions would need to have the codes changed [11]. In our project, we use Haar-like feature detection algorithm to detect faces. Even though single strong classifier can detect most facial features correctly, it still has considerable high false positive rates; hence we apply the cascading method [13]. Using cascade classifiers, our program scans every sub-window of the input feed image and classifies them as face, or non-face [14]. Majority of the non-face features is eliminated in the first few stages of cascading process, and then lets the program focus on the relevant face window. This method is very efficient since it is executed very fast and precisely.

The cascade classifier for multi-view face detection can scan the sub-windows in every position and scale of the input image, and classify each sub-window into face or non-face [12]. Both frontal face and profile face can be detection by this system. In the process of classification in the first few levels, the system can quickly eliminate a large number of non-face sub-windows, and then let the rest level of the cascade classifier focused on the suspicious face sub-window [14]. This detection method can achieve face detection rapidly and precisely. After the test in different kinds of dataset, we found that the cascade classifier can achieve high accuracy face detection and reach the requirement of face detection in real-time [10].

III. DESCRIPTION OF THE PROPOSED MODEL

The development of the Attendance System based on Face Recognition and Verification by RFID is distributed into two significant unit, one is the hardware side and another one is the software. Personnel with proper authority can login into the system and look for information from there, which keeps a log of the ID, time and date of every student that enters into the classroom. It also can register new student using facial image, the tag ID of each tag.

A. Deatiled circuit description

In this segment, circuit components that we have used for our proposed model are being displayed in Figure 2. We have designed our circuit by Proteus Professional software.

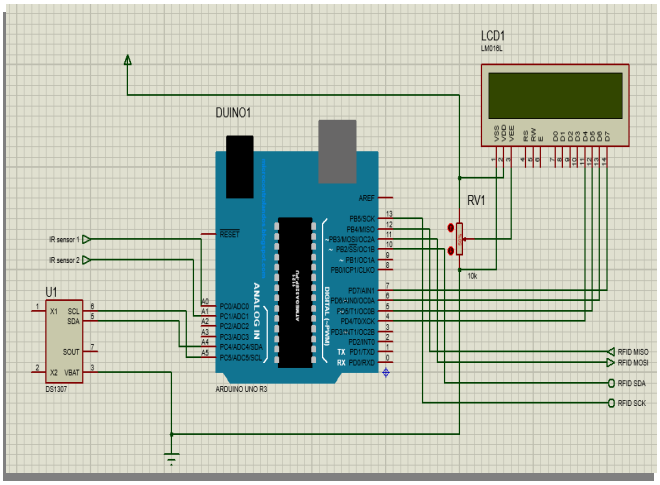

Figure 2. Circuit diagram of the RFID and LCD segment of our proposed project

In Figure 2 we can see that we have connected Arduino Uno R3 with a Real Time Clock (RTC), a LCD display, a Radio Frequency Module (RFID), 2 IR sensor modules. When the system will initialize, the LCD display will ask the student to show his tag or card. After the card being identified, the LCD will display the ID number the along with the time of his entrance. As he passes across the IR sensor, the system records the count of the student and displays the number on the LCD. If someone leaves classroom, counting goes down.

However, the most challenging and effective part is incorporating Face Recognition with the system. It ensures the accuracy of the system in identifying the authorized person. As face recognition is verified by another system developed by RFID, we can say the system nearly perfect identification and counting system. However, we are also planning to connect both system to run together and add a storage system through which we will be able to keep all the data.

B. Hardware implementation of our project

In the following section, we are going to discuss about how we implemented the hardware of our proposed project Attendance System based on Face Recognition and Verification by RFID. From Figure 3 to Figure 11 describe the hardware implementations.

Figure 3 is displaying the basic circuit design of our project. Here we can see that the LCD is connected to the bread board. Also, a LED, a RTC are connected. All of them combined connected to Arduino uno. And the Arduino is connected to the laptop from where it is going to get power and run the whole module. The LCD and LED are the output here. There is a pot also which works as the contrast controller of the LCD display. We can set the contract by using it whenever we need to do that.

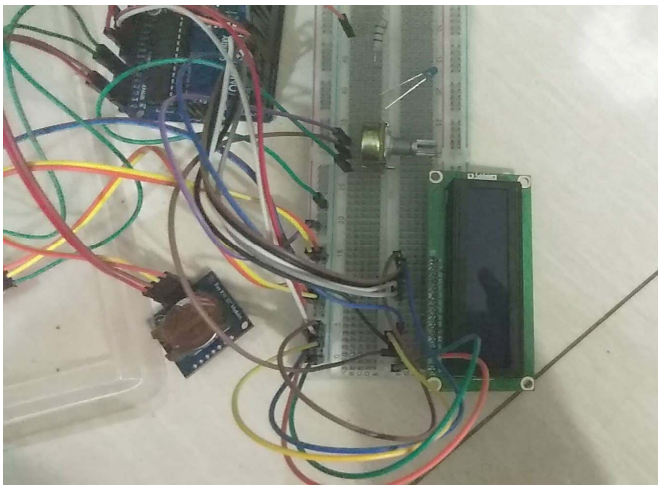

Figure 3. LCD and RTC connected with Arduino through breadboard

In Figure 4, we can see that 2 IR modules and a RFID is connected with the Arduino uno. The function of the IR modules are they are basically going to count the number of the students and when the count is 1 then the LED will glow and when the count will be 0 the LED will turn of. Every student is going to have a RFID tag and when they will touch it to the module the LCD will display their ID with the time stamp and will entry it to the log.

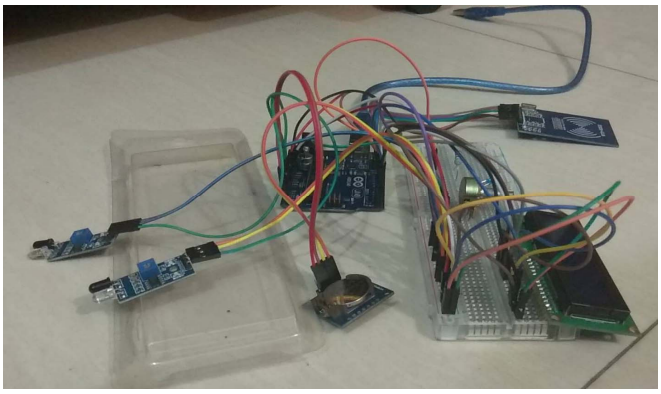

Figure 4. RFID reader and IR modules are connected with Arduino

This Figure 5 is mainly displaying our half potion of the project which includes the RFID module, IR sensor, Arduino uno, LCD display, LED which are connected to the laptop and also the RFID tags that the students are going to use.

Figure 6 is showing the ID of a student with the time stamp who has just punched his RFID tag or card to the RFID module. Each time when a student is going to that the LCD display will show like this.

Figure 5. The full module with sensor inside the packaged box.

Figure 6. LCD showing the reading of RFID tag and timestamp

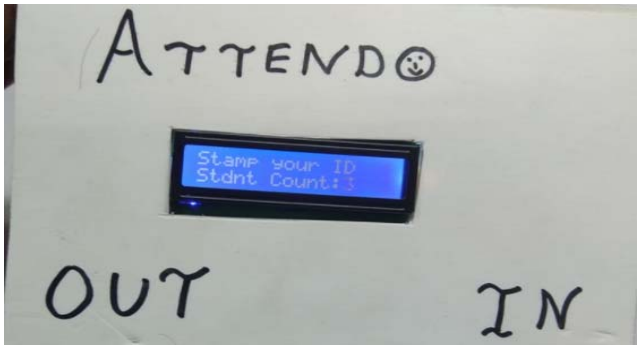

Figure 7. LCD asking for ID card and showing student count

In Figure 7 we can see that before entering the class the LCD will ask for the RFID tag from the student and punching the tag or the card whenever he/she passes through the IR module it will show the count on the LCD display and it will be entered into the log and the whole system will work accordingly.

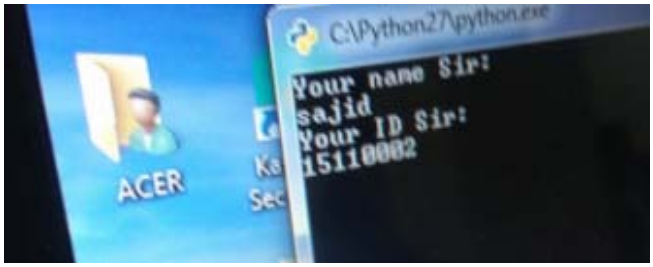

Figure 8. Data is entered for image dataset entry

Figure 8 is showing us that how we are going to update our registry or log. Basically when we going the give the input to the database the system will ask for the name of the student and also the ID. We have to enter that information accordingly.

Figure 9. Webcam detecting and taking inputs for dataset.

Figure 10. The camera recognizing the face and showing appropriate ID

Figure 9 is showing us that what we will do after the next step. After enter the name and ID the program will ask for the photo of the student. He/she has to stand in front of the camera and the camera will take 20 snaps simultaneously and store it in its database. One thing we have to remember that for accuracy we have to move our face in different angle and there have to be sufficient light.

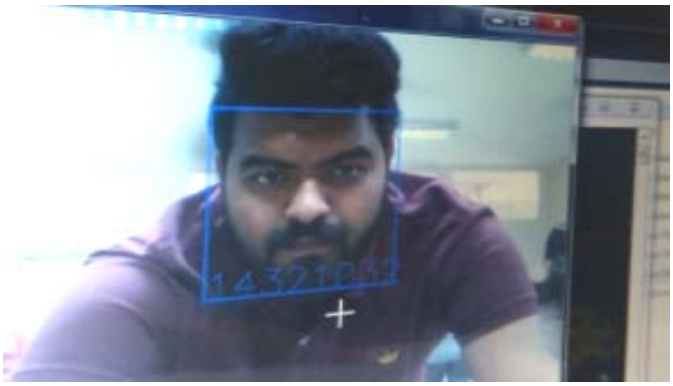

Figure 11. Recognition of a different student with appropriate ID

In Figure 10 and 11, we can see that the system has successfully identified the two students whose info and photo was entered into the database. Whenever a student is going to stand in front of the camera if he is authorized it will display his ID into the square block and his attendance will be logged in the main database automatically. After that he can easily enter into the class room by passing the IR modules. The above figures describe each stage how the system work. Face is detected after being matched with stored data. As soon as the face is recognized, it shows the face with

identification number. Next stage is to show ID card to the reader, LCD display again shows his particulars. After that as he crosses the first IR sensor to get in the class, count goes up. This counted number will be displayed on LCD.As the students leave the class room crossing another IR sensor, count goes down and is played on LCD.

We can implement the two systems, face recognition and Identification by RFID to merge in one system and also add a storage system for our project. Due to lack of time we could not add the feature yet.

IV. CONCLUSION

The design and implementation of the Attendance System based on Face Recognition and Verification by RFID which was our aim and objective of the paper at the beginning ends with a success as both part works as desired. There it goes without any saying that our proposed model has the potential to overcome the manual attendance system because it's efficient and convenient. Our model is more user friendly and it provides the most accurate and organized data. And with just some few modification we can use our system in any secured facilities.

REFERENCES

[1] N. Amiyana and M. Alias, "Attendance and Access Control System Using RFID System," undergraduate thesis, Faculty of Electronic and Computer Engineering, Universiti Teknikal Malaysia Melaka, pp.1-24, 2011.

[2] H. Lehpamer, "RFID Design and Principles," Second Edition, Artech House, Inc., 2008.

[3] C. E. Geoffrey, "Automatic Access Control System using Student's Identification Card based on RFID Technology," Unpublished Thesis Faculty of Electrical Engineering, University of Teknologi Malaysia, 2012.

[4] K. D. Mahajan, P. Pandey and B. K. Pandher, "Application of RFID Technology in Libraries and Role of Librarian," In 12th MANLIBNET Convention 2010, Jaipur (India), pp. 109-118, 2010.

[5] M. P. V. Mojares, G. A. T. Litan and J. G. Mojares, "iNotified: An SMS and RFID-Based Notification System of Lipa City Colleges," Journal of Applied Global Research, vol. 6, no. 18, pp. 36-47, 2013.

[6] A. Parvathy, V. R. Raj and M. Reddy, "RFID based exam hall maintenance system," IJCA Special Issue on Artificial Intelligence Techniques-Novel Approaches & Practical Applications (AIT), 2011.

[7] B. M. Stephen, E. S. Sanjay and R. W. John, "RFID Technology and Applications", Cambridge University Press, 2008.

[8] Z. N, Zhang, Y. W. John, "Inducement Analysis in Facial Expression Recognition", In 8th International Conference on Signal Processing, IEEE Press, pp. 1654-1657, 2006.

[9] Ying Zilu, Li Jingwen, Zhang and Y. W. Samuel, "Facial Expression Recognition Based on Classifier Combinations," 8th International Conference on Signal Processing, IEEE Press, pp.1628-1632, 2006.

[10] R. P. W. Duin, P. Juszczak, P. Paclik, E. Pekalska and D. Ridder, D. M. J. Tax, "A Matlab Toolbox for Pattern Recognition," Delft University of Technology, 2004.

[11] Y. N. Chen; C. C. Han; C. T. Wang; B. S. Jeng; K. C. Fan, "A CNN-based face detector with a simple feature map and a coarse-to-fine classifier - Withdrawn," in IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. PP, no. 99, pp. l-l

[12] A. Torralba, K. P. Murphy and W. T. Freeman, "Sharing Visual Features for Multiclass and Multiview Object Detection," in IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 29, no. 5, pp.854-869, 2007.

[13] C. P. Papageorgiou and M. Oren, "A general framework for object detection," Comput. Vision, JEEE Jnt. Conf., vol. 0, no. January, pp.555-562, 1998.

[14] "The Facial Recognition Technology (FERET) Database", webpage on NJST. [online]. http://www.itl.nist.gov/iad/humanid/feret/.

[15] S. Islam, A. Mahmud, A. Papeya, I. Onny and J. Uddin, "A Combined Feature Extraction Method for Automated Face Recognition in Classroom Environment," 3rd International Symposium on Signal Processing and Intelligent Recognition Systems, SIRS'17, Karnataka, India, vol 678, pp. pp 417-426, 2017.